Patent Abstracts of Japan

PUBLICATION NUMBER : 2001140665
PUBLICATION DATE : 22-05-01

APPLICATION DATE : 17-11-99
APPLICATION NUMBER : 11326677

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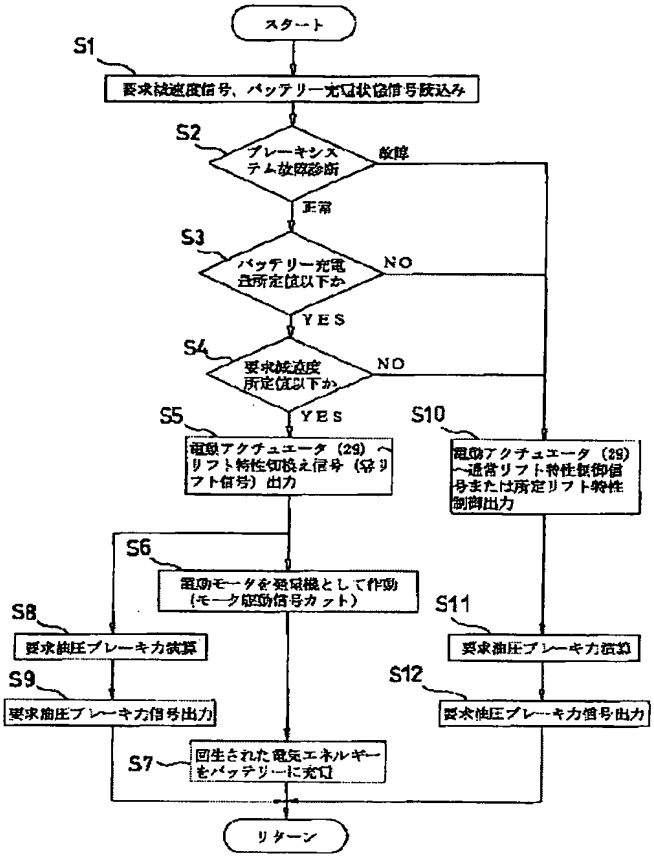
INT.CL. : F02D 13/08 B60K 6/02 B60L 7/24
F01L 13/00 F01L 13/06 F02D 13/02
F02D 29/02

TITLE : POWER SOURCE CONTROL DEVICE FOR VEHICLE



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PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-140665

(43)Date of publication of application : 22.05.2001

(51)Int.Cl. F02D 13/08
B60K 6/02
B60L 7/24
F01L 13/00
F01L 13/06
F02D 13/02
F02D 29/02

(21)Application number : 11-326677

(22)Date of filing : 17.11.1999

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(54) POWER SOURCE CONTROL DEVICE FOR VEHICLE

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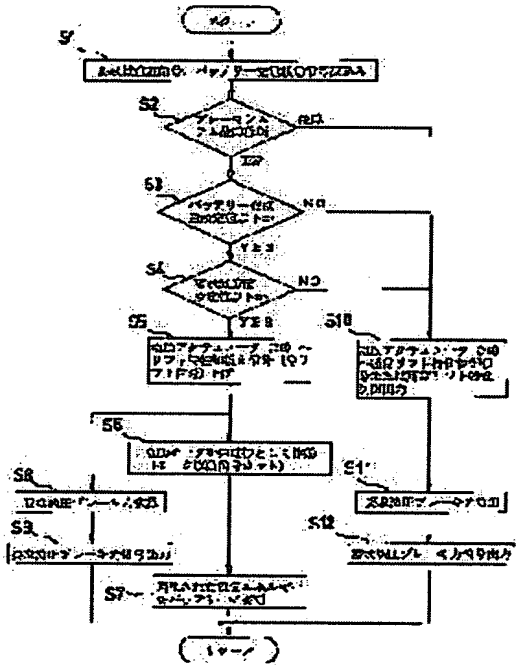

LEGAL STATUS

[Date of request for examination] 27.03.2003

[Date of sending the examiner's decision of rejection] 24.02.2004

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection] 2004-05941

[Date of requesting appeal against examiner's decision of rejection] 25.03.2004

[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1] In the source control unit of power of the car which controls that of an internal combustion engine's power and the power of an electric motor according to the operational status of a car The lift adjustable means which carries out adjustable control of the amount of valve lifts of said internal combustion engine's engine valve, The brake mechanism which brakes a car, and a demand decelerating detection means to detect the demand deceleration of the operator at the time of braking of this car, A zero lift conversion means to control said engine valve by said lift adjustable means to a zero lift when the demand decelerating value detected by this demand decelerating detection means is below a predetermined value, The source control unit of power of the car characterized by having a regeneration conversion means to make electrical energy revive the kinetic energy transmitted from the wheel according to a generation-of-electrical-energy operation of said electric motor when a demand decelerating value is similarly below a predetermined value.
[Claim 2] It is the source control unit of power of the car according to claim 1 characterized by establishing a zero lift discharge means to cancel zero lift control of the engine valve by said zero lift conversion means when the demand decelerating value detected by said demand decelerating detection means is over the predetermined value.
[Claim 3] The source control unit of power of the car according to claim 2 characterized by to constitute so that said zero lift discharge means may cancel zero lift control even if said demand decelerating value is below a predetermined value when the dc-battery charge detected by said charge condition detection means is over the predetermined value, while establishing a charge condition detection means detect the charge condition of the dc-battery which supplies a current to said electric motor.
[Claim 4] The source control unit of power of the car according to claim 2 or 3 characterized by constituting so that said zero lift discharge means may cancel zero lift control even if said demand decelerating value is below a predetermined value when a fault detection signal is outputted from this brake fault detection means, while establishing the fault detection means of said brake mechanism.
[Claim 5] The source control unit of power of the car according to claim 2 to 4 characterized by controlling an engine valve by said zero lift conversion means to a zero lift just before stopping a drive of said internal combustion engine.
[Claim 6] A lift adjustable means is the source control unit of power of the car according to claim 2 to 5 characterized by carrying out adjustable control of the amount of valve lifts of said engine valve at continuation according to engine operational status.
[Claim 7] The driving shaft with which said lift adjustable means was rotated synchronizing with an engine's crankshaft, and the drive cam was prepared in the periphery, The rocking cam which it is supported [cam] by the predetermined pivot free [rocking], and the spring force of a valve spring is resisted [cam], and carries out open actuation of the engine valve, The transfer device in which the turning effort of said driving shaft is transmitted to a rocking cam as rocking force, The source control unit of power of the car according to claim 1 to 6 characterized by having the control cam to which the posture of this transfer device is changed and the maximum of the amount of lifts of the engine valve by said rocking cam is changed, and the electric actuator which carries out the rotation drive of the control axis which controls the rotation location of this control cam.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention uses the power of both the usual internal combustion engine and an electric motor as a source of power of a car, and relates to the source control unit of power of the car which controlled the source of power of these both suitably according to the operational status of a car.
[0002]
[Description of the Prior Art] As everyone knows, if it is in cars, such as a passenger car, recently, from the request of reduction of the environmental pollution by exhaust gas, improvement in fuel consumption, etc., both a common gasoline internal combustion engine's power and the power of an electric motor are used for the source of power, what controls both power suitably according to the operational status of a car is offered, and what is shown in drawing 12 is known as the example.
[0003] If an outline is explained, the source control unit of power of this car makes an internal combustion engine power fundamentally, and internal combustion engine power is divided into the driving force and generator driving force to a wheel etc. by the power division device which used the epicyclic gear.
[0004] That is, while the gasoline internal combustion engine 54 and the electric motor 55 have coordinated with the axle 53 of front wheels 51 and 52 through a reducer 56, the power division device 58 which distributes an internal combustion engine's 54 power to transfer shaft 57 driving force and generator driving force mechanically by the epicyclic gear is arranged between an internal combustion engine's 54 output-shaft 54a, and the transfer shaft 57 which is an input shaft of a reducer 56. Moreover, the generator 61 which supplies the power for accumulation of electricity to a dc-battery 59 is connected with this power division device 58. Moreover, a drive current is supplied to said electric motor 55 from a dc-battery 59 through an inverter 60.
[0005] And it is made to run with the power of an electric motor 55 in the time of start of a car, or a operating range with the very bad power effectiveness of internal combustion engines, such as the time of low-speed transit.
[0006] Moreover, at the time of transit, the power division device 58 divides an internal combustion engine's 54 power into two paths, one power carries out the direct drive of the wheels 51 and 52, and the power of another side drives a generator 61, with this power, it drives an electric motor 55 and usually assists the internal combustion engine [driving force] 54.
[0007] Furthermore, when a throttle valve is fully opened, for example in the time of sudden acceleration etc. and acceleration transit is performed, the power other than a generator 61 is supplied also from a dc-battery 59 to an electric motor 55, and driving force is made to increase further.
[0008] Moreover, when a car is slowed down or an operator makes a brake pedal break in and brake, while idling or stopping an internal combustion engine 54, that is, operating chisels, such as a piston, without supplying a fuel to a combustion chamber, or also stopping actuation of a piston etc., drive an electric motor 55 and it is made to act as a generator, and wheels 51 and 52 perform a regeneration generation of electrical energy, and store electricity the collected electrical energy at a dc-battery 59.
[0009] Thus, although an internal combustion engine's 54 power is fundamentally made into the source of power of a car, the improvement of the environmental deterioration according to improvement in an internal combustion engine's 54 fuel consumption and reduction-izing of the amount of exhaust gas the time of start of a car and when an electric motor 55 assists the internal combustion engine [power] 54 at the time of transit and acceleration transit etc. can further usually be aimed at very much by considering as the power of only an electric motor 55 in the time of low-speed transit.
[0010]
[Problem(s) to be Solved by the Invention] However, as mentioned above, if it is in the source control unit of power of said conventional car, while idling or stopping an internal combustion engine 54, in order for wheels 51 and 52 to drive an electric motor 55, to make it function as a generator and to generate regeneration power, the following technical technical problems are invited at the time of moderation of a car and braking.
[0011] That is, when idling an internal combustion engine 54, while the gas exchange loss by closing motion of an internal combustion engine's 54 inlet valve and an exhaust valve, i.e., the pumping loss by the pumping, occurs first, the so-called engine brake will act in connection with this, and rotation of wheels 51 and 52 will be decelerated, consequently the effectiveness of the regeneration generation of electrical energy by the electric motor 55 will fall.
[0012] Then, in order to reduce said gas exchange loss, making a throttle valve full open further is also considered, but if it does in this way, shortly, the cold which flowed into the combustion chamber through the inlet valve from the suction port will pass through the inside of an exhaust air catalyst from the inside of an exhaust pipe through an exhaust valve as it is, and this exhaust air catalyst will be cooled. For this reason, the purification capacity of this exhaust air catalyst will decline, and the exhaust gas emission engine performance when an internal combustion engine's 54 combustion is started next will fall.
[0013] Moreover, when it was the case where an internal combustion engine 54 was stopped, by the time it put the internal combustion engine 54 into operation and raised rotation further on the occasion of re-acceleration, it required and had time amount, and there was a problem that the response of re-acceleration was bad.
[0014]
[Means for Solving the Problem] This invention is what was thought out in view of the technical technical problem of the source control unit of power of said conventional car. Invention according to claim 1 In the source control unit of power of the car which controls an internal combustion engine's power and the power of an electric motor according to the operational status of a car The lift adjustable means which carries out adjustable control of the amount of valve lifts of said internal combustion engine's engine valve, The brake mechanism which brakes a car, and a demand decelerating detection means to detect the demand deceleration of the operator at the time of braking of this car, A zero lift conversion means to control said engine valve by said lift adjustable means to a

zero lift when the demand decelerating value detected by this demand decelerating detection means is below a predetermined value, When a demand decelerating value is similarly below a predetermined value, it is characterized by having a regeneration conversion means to make electrical energy revive the kinetic energy transmitted from the wheel according to a generation-of-electrical-energy operation of said electric motor.

[0015] Therefore, since it will be in a valve idle state, i.e., a close-by-pass-bulb-completely condition, by controlling the valve lift of the inlet valve which is an engine valve, or an exhaust valve to a zero lift at the time of braking of a car when an operator's demand deceleration is below a predetermined value according to this invention, the gas exchange loss by the induction-exhaust valve is avoided, and the so-called engine brake stops being able to start easily. Consequently, moderation of the wheel by the internal combustion engine is controlled, and the recovery effectiveness of the regeneration electrical energy by the electric motor becomes high.

[0016] Invention according to claim 2 is characterized by establishing a zero lift discharge means to cancel zero lift control of the engine valve by said zero lift conversion means, when the demand decelerating value detected by said demand decelerating detection means is over the predetermined value.

[0017] Therefore, since engine brake is also made to operate besides braking by the usual oil pressure in order to perform the usual closing motion actuation, i.e., the pump actuation by the gas exchange, without carrying out zero lift control of the engine valve, when an operator performs for example, slam-on-the-brake actuation, powerful damping force is acquired.

[0018] While establishing a charge condition detection means detect the charge condition of the dc-battery which supplies power to said electric motor, when the dc-battery charge detected by said charge condition detection means is over the predetermined value, invention according to claim 3 is characterized by to constitute so that said zero lift discharge means may cancel zero lift control, even if said demand decelerating value is below a predetermined value.

[0019] According to this invention, recovery of too much regeneration power by the electric motor can be prevented, securing a desired dc-battery charge.

[0020] While establishing the fault detection means of said brake mechanism, when a fault detection signal is outputted from this brake fault detection means, even if invention according to claim 4 is said below demand decelerating value, it is characterized by constituting so that said zero lift discharge means may cancel zero lift control.

[0021] According to this invention, at the time of failure of the brake mechanism by the usual oil pressure etc., it becomes possible to secure engine brake at least.

[0022] Invention according to claim 5 is characterized by controlling an engine valve by said zero lift conversion means to a zero lift, just before stopping a drive of said internal combustion engine.

[0023] According to this invention, since the friction of the valve gear system at the time of an internal combustion engine's restart can be reduced, good restart nature or the start engine performance of a good car is obtained.

[0024] Invention according to claim 6 is characterized by carrying out adjustable control of the amount of valve lifts of said engine valve at continuation according to engine operational status with the lift adjustable means.

[0025] Since according to this invention this lift change can be continuously reduced gently-sloping in case the valve lift of an engine valve is controlled for example, from the maximum lift to a zero lift, a rapid actuation change of engine brake can be prevented and the stable feeling of a brake is obtained.

[0026] The driving shaft with which invention according to claim 7 rotated said lift adjustable means synchronizing with an engine's crankshaft, and the drive cam was prepared in the periphery, The rocking cam which it is supported [cam] by the predetermined pivot free [rocking], and the spring force of a valve spring is resisted [cam], and carries out open actuation of the engine valve, The transfer device in which the turning effort of said driving shaft is transmitted to a rocking cam as rocking force, It is characterized by constituting the control axis which controls the rotation location of the control cam to which the posture of this transfer device is changed and the maximum of the amount of lifts of the engine valve by said rocking cam is changed, and this control cam from an electric actuator which carries out a rotation drive.

[0027] Since it can be made to operate with said regeneration power by having used the electric actuator while enabling a zero lift to a high lift to control the amount of valve lifts of an engine valve greatly enough according to this invention, while being able to aim at a deployment of regeneration power, an oil pressure driving source, an oil pressure drive, etc. become unnecessary separately.

[0028]

[Embodiment of the Invention] Hereafter, the operation gestalt of the source control unit of power of the car concerning this invention is explained in full detail based on a drawing.

[0029] A pair each front-wheels 2a prepared before and after the car body 1 as the source control unit of power of the car of this operation gestalt was shown in drawing 1 , 2b, and rear wheels 3a and 3b, With front-wheel 2a and the gasoline internal combustion engine 5 of a 4-cylinder which transmits power to 2b through an axle 4 With this internal combustion engine's 5 power, or the electric motor 6 which makes front-wheel 2a and 2b drive independently, A lift adjustable means 7 to be formed in each gas column of said internal combustion engine 5, and to control each amount of valve lifts of the inlet valve 12 which is an engine valve, and the exhaust valve outside drawing according to engine operational status, It has the oil pressure brake mechanism 8 which brakes said order ring 2a, 2b, and 3a and 3b, and the controller 9 which controls said two sources of power suitably according to the operational status of a car.

[0030] The differential gear 10 which transmits each power of an internal combustion engine 5 and an electric motor 6 to front-wheel 2a and 2b is formed in said axle 4.

[0031] Said lift adjustable means 7 is formed in the valve gear which it has on the cylinder head 11 as said internal combustion engine 5 also shows drawing 2 . If what was applied to the inlet-valve 12 side is explained for convenience, this lift adjustable means 7 Two the inlet valves 12 and exhaust valves per 1 cylinder which slide on the inside of the cylinder head 11 through the valve guide outside drawing, and open and close a pumping port, The driving shaft 13 of the shape of hollow supported by the bearing 14 of the cylinder head 11 upper part free [rotation], One drive cam 15 which is an eccentric rotating cam fixed to this driving shaft 13, The rocking cam 17 which ****s to the valve lifters 16 and 16 which were supported by peripheral face 13a of a driving shaft 13 free [rocking], and were arranged in the upper limit section of each inlet valves 12 and 12, It was coordinated between the drive cam 15 and the rocking cam 17, and has the transfer device 18 in which the turning effort of the drive cam 15 is transmitted as rocking force of the rocking cam 17, and the adjustable device 19 which makes adjustable the actuated position of this transfer device 18.

[0032] While said driving shaft 13 is arranged along with the engine cross direction, turning effort is transmitted from an engine's crankshaft through the timing chain around which the driven sprocket wheel and this driven sprocket wheel outside drawing established in the end section were looped, and this hand of cut is set as the counterclockwise rotation in drawing 2 . In addition, the driving shaft 15 is formed by high intensity material.

[0033] It has subbracket 14b which said bearing 14 is formed in the upper limit section of Maine bracket 14a which is prepared in the

upper limit section of the cylinder head 11, and supports the upper part of a driving shaft 13, and this Maine bracket 14a, and is supported for the control axis 32 mentioned later, enabling free rotation, and ****** immobilization of both the brackets 14a and 14b is carried out from the upper part with the bolts 14c and 14c of a pair.

[0034] While said drive cam 15 is formed in one of antifriction material, and consists of circular ring-like cam section 15a and tubed part 15b prepared in the outer edge surface of this cam section 15a at one, as shown in drawing 4 , and penetration formation of the driving shaft insertion hole 15c is carried out at internal shaft orientations, the core Y of cam section 15a has offset only the specified quantity in the direction of a path from the axial center X of a driving shaft 13. Moreover, connection immobilization of this drive cam 15 is carried out by the connection pin 40 inserted in from the diameter to the driving shaft 13. Furthermore, this drive cam 15 is rotated to the counterclockwise rotation in drawing (the direction of an arrow head) with rotation of a driving shaft 13, as shown in drawing 2 .

[0035] While said valve lifters 16 and 16 are formed in the shape of a roofed cylinder and held in the maintenance hole of the cylinder head 11, enabling free sliding, the top faces 16a and 16a where the cam bodies 17a and 17a which the rocking cam 17 mentions later **** are formed in the shape of flatness.

[0036] It has the cam bodies 17a and 17a of a raindrop-like pair mostly. said rocking cam 17 was mostly formed in the both ends of the cylinder-like end face section 20 at one, as shown in drawing 2 and drawing 3 -- While the whole is supported free [rocking] by the driving shaft 13 which inserted in support hole 20a formed in the internal shaft orientations of the end face section 20, penetration formation of the pin hole is carried out at the cam-nose section 21 which it has in one end section side. The cam side 22 is formed in the inferior surface of tongue of each cam body 17a, respectively. Moreover, this cam side 22 Lift side 22c which stands in a row in 22d of top faces of the maximum lift which it has in the tip side of the cam-nose section 21 from lamp side 22b prolonged in the shape of radii in the cam-nose section 21 side from base circle surface 22a by the side of the end face section 20 and this base circle surface 22a and this lamp side 22b is formed. This base circle surface 22a, lamp side 22b, lift side 22c, and 22d of top faces contact the top-face 16a predetermined location of each valve lifter 16 according to the rocking location of the rocking cam 17.

[0037] That is, in view of the valve-lift property shown in drawing 5 , it is set up so that the predetermined include-angle range theta 1 of base circle surface 22a may become the base circle section, the predetermined include-angle range theta 2 may serve as the so-called lamp section from said base circle section theta 1 of lamp side 22b and the predetermined include-angle range theta 3 to 22d of top faces may become the lift section from the lamp section theta 2 of lamp side 22b further. Moreover, the circular ring-like attachment component 34 is formed between the end face section 20 end side of this rocking cam 17, and the drive cam 15. This attachment component 34 is mostly formed in the outer diameter of the diameter of said with the outer diameter of tubed part 15b of the drive cam 15, as shown in drawing 6 , and fit-in maintenance is carried out through central hole 34a at the driving shaft 13.

[0038] the two forks of the link arm 24 which coordinates the rocker arm 23 by which said transfer device 18 has been arranged above a driving shaft 13, and end section 23a of this rocker arm 23 and the drive cam 15, and a rocker arm 23 -- it has the link rod 25 which coordinates other end 23b of a **, and the rocking cam 17.

[0039] Said rocker arm 23 is supported free [rotation] by the control cam 33 which tubed base 23c which it has in the center as shown in drawing 2 mentions later through 23d of support holes. Moreover, while penetration formation of the pin hole which a pin 26 inserts is carried out, penetration formation of the pin hole which the pin 27 connected with end section 25a of a link rod 25 inserts in each other end 23b which protruded on the toe of base 23c, respectively is carried out at end section 23a which protruded on the heel of tubed base 23c, respectively.

[0040] Moreover, comparatively major diameter link arm [said / 24] end face section 24a which is the circular ring-like end section, It has protrusion edge 24b which is the other end which protruded on the peripheral face predetermined location of this end face section 24a. To the mid gear of end face section 24a While fitting hole 24c which fits into the peripheral face of cam section 15a of said drive cam 15 free [rotation] through a needle bearing 34 is formed, penetration formation of the pin hole inserted in protrusion edge 24b free [rotation of said pin 26] is carried out. Axial center 26a of this pin 26 is a supporting pivotably pivotably point with end section 23a of a rocker arm 23.

[0041] Furthermore, penetration formation of the pin insertion holes 25c and 25d which it is mostly formed in the shape of ******, and a rocker arm 23 side inserts in free [rotation of the edge of each concave pins 27 and 28 pressed fit in each pin hole of the cam-nose section 21 of other end 23b of said rocker arm 23 and cam body 17a in both ends 25a and 25b] as said link rod 25 is shown also in drawing 2 is carried out.

[0042] Moreover, while the snap ring outside drawing which regulates migration of the shaft orientations of the link arm 24 or a link rod 25 is prepared in the end section of each pins 26, 27, and 28, the axial centers 27a and 28a of each pins 27 and 28 are supporting pivotably pivotably points with the cam-nose section 21 of other end 23b of the both ends 25a and 25b of a link rod 25, and a rocker arm 23, and the rocking cam 17.

[0043] Moreover, the needle bearing 35 which is an anti-friction-bearing member is infixed between inner skin 24c of end face section 24a of the link arm 24 which fits into 15d of peripheral faces of cam section 15a of said drive cam 15, and this cam section 15a. This needle bearing 35 consists of circular ring-like cage 35a and two or more needle roller 35b held free [rotation] at this cage 35a.

[0044] Moreover, as this needle bearing 35 is shown in drawing 2 R> 2, that whole is held by the peripheral face of cam section 15a, and the both-ends edge of cage 35a is pinched by drive cam 1 side face and one side face of an attachment component 34 in the driving shaft 13 direction. Here, since the drive cam 15 and the attachment component 34 are formed by antifriction material, generating of wear is controlled even if it slides with cage 35a.

[0045] Said adjustable device 19 is equipped with the control axis 32 supported free [rotation] by the same bearing 14 as the upper part location of a driving shaft 13, and the control cam 33 which is fixed to the periphery of this control axis 32, and serves as the rocking supporting point of a rocker arm 23.

[0046] Said control axis 32 rotates by predetermined angle-of-rotation within the limits with the electric actuator 29 through the worm wheel 36 and worm gear 37 which are the worm wheel established in the end section while being arranged in the engine cross direction in parallel with the driving shaft 13, as shown in drawing 2 .

[0047] Said control cam 33 presents the shape of a cylinder, and as shown in drawing 2 , axial center P1 location is deflecting only the part of thick section 33a from the axial center P2 of a control axis 32 by alpha.

[0048] Moreover, the electric actuator 29 which carries out the roll control of said control axis 32 is driven with the control signal from the controller 9 which detects an engine's operational status as shown in drawing 3 .

[0049] While having coordinated said electric motor 6 with said differential gear 10 through motor output-shaft 38a and having coordinated it with the change gear 39 formed in an internal combustion engine's 5 end side through motor input-shaft 38b, the current changed into the alternating current from the direct current is supplied from dc-battery 41 power source through an inverter 40. Furthermore, this electric motor 6 functions as a generator on the turning effort of said front-wheel 2a and 2b, and it is constituted so that an alternating current may be changed into a direct current and regeneration power may be supplied to a dc-battery 41 through an

inverter 40, while that drive is controlled by the output signal from said controller 9 through an inverter 40.
[0050] Furthermore, the master cylinder 43 which is the brake hydraulic power unit which said oil pressure brake mechanism 8 makes generate oil pressure by treading in of a brake pedal 42, and supplies oil pressure to each wheel cylinder of order ring 2a, 2b, and 3a and 3b, It mainly consists of the oil-pressure-regulation section 44 which consists of the object for a boost which adjusts the supply oil pressure from this master cylinder 43 to each wheel cylinder, a valve for reduced pressure, a hydraulic pump, etc., and a control circuit 45 which controls actuation of the object for a boost of this oil-pressure-regulation section 44, the valve for reduced pressure, etc. Moreover, this oil pressure brake mechanism 8 is controlled by said controller 9 through a control circuit 45.
[0051] Said controller 9 is outputting the control signal to said electric actuator 29 by the detecting signal from the potentiometer 31 which detects the rotation location of a control axis 32 while detecting current engine operational status by an operation etc. based on the detecting signal from various kinds of sensors, such as a crank angle sensor, and an air flow meter, a coolant temperature sensor. Moreover, this controller 9 has detected the charge condition of the current dc-battery 41 by the detecting signal from the charge condition detection sensor 46. Furthermore, while outputting a demand oil pressure brake-force signal to said control circuit 45 based on the demand decelerating signal from the treading-in speed detection sensor 47 which detects the treading-in rate of a brake pedal 42, and the detecting signal from the G sensor 48, the present demand deceleration judges whether it is below a predetermined value.
[0052] Hereafter, if an operation of this operation gestalt is explained, fundamental control of the lift adjustable means 7 by the controller 9 will be explained briefly first.
[0053] first -- if zero lift control is explained -- the control signal from a controller 9 -- electromagnetism -- the rotation drive of the control axis 32 is clockwise carried out through an actuator 29. for this reason, the control cam 33 is held from the axial center P2 of a control axis 32 to the rotation angular position of upper left direction, as an axial center P1 shows drawing 7 -- having -- thick section 33a -- the supporting pivotably pivotably point 26a side from a driving shaft 13 -- alienation -- it moves. For this reason, the whole moves a rocker arm 23 in the direction of the upper left to a driving shaft 13, for this reason, the cam-nose section 21 side can pull up compulsorily each cam bodies 17a and 17a through a link rod 25, and the whole rotates them to a counterclockwise rotation.
[0054] Therefore, although the amount of lifts will be transmitted to the rocking cam 17 and a valve lifter 16 through a link rod 25 if the drive cam 15 rotates and end section 23a of a rocker arm 23 is pushed up through the link arm 24 during closing motion actuation of inlet valves 12 and 12 as shown in drawing 7 A and B, the amount of lifts becomes zero.
[0055] Therefore, since the amount of valve lifts becomes a zero lift as shown in drawing 9 , while friction decreases, gas exchange loss is avoided and the so-called engine brake stops being able to start easily. Consequently, if it controls to this zero lift at the time of moderation, the recovery effectiveness of the regeneration electrical energy by the electric motor 6 will become high. Or if it controls to the zero lift applied at the time of low-speed stationary transit, improvement in fuel consumption can be aimed at by driving a car only with an electric motor 6.
[0056] In addition, the fuel supply to an internal combustion engine 5 is intercepted by the control signal from a controller 9 at this time.
[0057] while an engine's load and a rotational frequency take for increasing and a fuel is supplied to an internal combustion engine 5 by the control signal from a controller 9 by the usual engine operational status on the other hand -- electromagnetism -- the rotation drive of the control axis 32 is counterclockwise carried out through worm wheels 36 and 37 by the actuator 29. Therefore, it rotates to a counterclockwise rotation from the location shown in drawing 7 , and as shown in drawing 8 , an axial center P1 (thick section 33a) moves the control cam 33 downward. For this reason, other end 23b presses the cam-nose section 21 of the rocking cam 17 below through a link rod 25 by the whole moving a rocker arm 23 in the driving shaft 13 direction (down) shortly, and only the specified quantity rotates this rocking cam 17 whole to a clockwise rotation.
[0058] Therefore, as the contact location of the cam side 22 over each valve-lifter 16 top-face 16a of each cam bodies 17a and 17a shows drawing 8 A and B, it moves to a rightward location (22d side of lift sections). For this reason, if the drive cam 15 rotates and end section 23a of a rocker arm 23 is pushed up through the link arm 24, that amount of lifts to a valve lifter 16 will become large. In a high rotation heavy load, especially the amount of lifts serves as maximum L2.
[0059] Therefore, in this high-speed heavy load region, as shown in drawing 9 , while the amount of valve lifts becomes large and the open stage of each inlet valve 12 becomes early, a closed stage becomes late. Consequently, an inhalation-of-air charging efficiency improves and sufficient output can be secured.
[0060] Next, it explains based on the flow chart shown in drawing 10 by the controller 9 about control of said lift adjustable means 7 at the time of braking of a car, and control of an electric motor 6.
[0061] First, if an operator gets into a brake pedal 42, while reading an outputting-from aforementioned treading-in speed detection sensor 47 current demand decelerating signal with a section 1, the charge condition of the dc-battery 41 from the charge condition detection sensor 46 is read. Then, in a section 2, it distinguishes whether the oil pressure brake mechanism 8 is out of order, and if this is normal, it will go to a section 3 and a dc-battery charge will distinguish whether it is below a predetermined value here. When a dc-battery charge distinguishes below a predetermined value here, it is a section 4 and said demand deceleration distinguishes shortly whether it is below a predetermined value. When it distinguishes that demand deceleration is below a predetermined value in this section 4, it goes to a section 5.
[0062] A control signal is outputted to said electric actuator 29, and the lift adjustable means 8 is controlled by this section 5 in a zero lift property. That is, the electric actuator 29 carries out the roll control of the control axis 32 like [at the time of said low-speed low load], and as shown in drawing 7 , thick section 33a of the control cam 33 is greatly moved to the supporting pivotably pivotably point 26a side from a driving shaft 13. Therefore, the valve lift of an inlet valve 12 (exhaust valve) becomes a zero lift property, as shown in drawing 9 R> 9, and it will be in a close-by-pass-bulb-completely condition.
[0063] While friction decreases, the gas exchange loss by the inlet valve 12 is avoided, and the so-called engine brake stops therefore, fully acting. At this time, a gas exchange is not made, but too much cooling of the exhaust air catalyst by cold new mind is prevented, and the purification performance degradation of an exhaust air catalyst is prevented.
[0064] Next, with a section 6, processing which cuts supply of the current to an electric motor 6 is performed, and although it starts the operation as a generator, since engine brake cannot start easily as mentioned above as for an electric motor 6, it performs a regeneration generation of electrical energy efficient as a generator. Then, in a section 7, processing which supplies this regeneration current to a dc-battery 41, and performs a charging effect is carried out.
[0065] On the other hand, with a section 8, after performing zero lift control of an inlet valve 12 in said section 5, in order to realize demand deceleration, the demand oil pressure brake force in current [required in addition to the regenerative-brake force by said electric motor 6] is calculated. Next, a demand oil pressure brake-force signal is outputted to the control circuit 45 of said oil pressure brake mechanism 8 with a section 9. By this, the brake oil pressure of place constant pressure is supplied to each wheel cylinder so that the oil-pressure-regulation section 44 can acquire a demand oil pressure brake force, and this can realize demand deceleration.
[0066] Moreover, in said section 2, when it is judged that demand deceleration is [in / further / when it is judged that the oil pressure

brake mechanism 8 is out of order, and when it is judged in a section 3 that the dc-battery charge is over a predetermined value / a section 4] over a predetermined value, it goes to a section 10, respectively. In addition, failure of the oil pressure brake mechanism 8 is judged by contrast with the detection value of the G sensor 48, and demand deceleration.

[0067] And with this section 10, when a lift property or the usual lift property usual [according to not a zero lift but engine operational status] in valve-lift control of an inlet valve 12 (exhaust valve) is a zero lift, processing which controls the rotation location of a control axis 32 through the electric actuator 29 to become a predetermined lift property compulsorily is performed. Here, with the predetermined lift property, the inhalation-of-air valve-closing time term is considering as the lift property which tends to require the engine brake near the bottom dead point of a piston.

[0068] Since it follows, for example, the brake force by engine brake can be secured at least at the time of failure of the oil pressure brake mechanism 8, safety becomes high. Moreover, since it was made not to generate a regeneration generation of electrical energy, too much actuation of an electric motor 6 is controlled, and a dc-battery overcurrent protection can be planned with improvement in endurance, without demonstrating the function as a generator by the electric motor 6 by said processing of a section 10, also when the dc-battery charge is over the predetermined value. Furthermore, since zero lift control of an inlet valve 12 (exhaust valve) is not performed when demand deceleration is over the predetermined value (i.e., also when slam-on-the-brake actuation is performed), the powerful brake force by engine brake can be generated.

[0069] Moreover, if it progresses from a section 10 and shifts to sections 11 and 12, in order to acquire demand deceleration, processing which secures a demand oil pressure brake force according to the oil pressure brake mechanism 8 as well as said sections 8 and 9 will be performed here.

[0070] In addition, not only the output of the treading-in speed detection sensor 47 but the detecting signal from the G sensor 48 and the vehicle speed signal from the speed sensor outside drawing may be synthetically taken into consideration, and a demand decelerating signal may output them after an operation. In that case, an operator's brake feeling improves.

[0071] Next, it explains based on the flow chart which shows control by the controller 9 at the time of stopping a drive of an internal combustion engine 5 to drawing 11 . That is, since it is not controlled by the zero lift as mentioned above in the case of a slam on the brake to which demand deceleration is over the predetermined value etc. and startability gets worse according to a lift being expensive at the time of the next internal combustion engine's 5 starting when a car is suspended in such the condition or key-off is carried out, this is improved.

[0072] First, with a section 21, when it judges whether the ignition switch was turned off and it is judged that it turned off, it goes to a section 23. moreover, it is now -- when it is judged that it is in an ON state, it goes to a section 22, and the vehicle speed judges whether it is below a predetermined value, and when it judges below as a predetermined value, it shifts [when it is judged that it is over a predetermined value, it returns to a section 21, and] to a section 23 here.

[0073] With this section 23, a control signal is outputted to the electric actuator 29 so that the valve-lift property of an inlet valve 12 (exhaust valve) may be controlled to a zero lift as mentioned above. Then, it goes to a section 24 and judges whether based on the signal from said potentiometer 31, the current valve lift is actually a zero lift here. Although it has returned and checks again when it is not actually a zero lift, when it is a zero lift, it goes to a section 25, the signal which stops a drive of an internal combustion engine 5 is outputted here, and an engine 5 is further stopped in a section 26.

[0074] Therefore, since the valve lift is a zero lift at the time of an internal combustion engine's 5 restart, the friction of a valve gear system becomes very small, and good startability is obtained. Moreover, an electric motor 6 starts operation, and since this internal combustion engine's 5 starting is performed also in case a car departs, start nature's of a car improves.

[0075] Moreover, according to this operation gestalt, the lift adjustable means 7 is written as the above configurations, and it becomes possible to make a valve lift into a property with the maximum lift to a continuous zero lift, as shown in said drawing 9 . Therefore, since the lift falls gently-sloping in case it controls to a zero lift, when a moderation demand is detected by the aforementioned treading-in speed detection sensor 47, it becomes possible to control the abrupt change of engine brake. Consequently, the stable brake feeling can be obtained.

[0076] And by having considered the lift adjustable means 7 as the above configurations, it becomes possible even for the maximum lift to change the amount of valve lifts a lot from zero, and improvement in an engine's 5 output can be aimed at, and the good power engine performance is also obtained by this.

[0077] Furthermore, since the electric actuator 29 was used as a driving means which carries out the rotation drive of the control axis 32 of the adjustable device 8, it can be made to drive using the regeneration power obtained with the electric motor 6. Consequently, while being able to aim at a deployment of regeneration power, since the special hydraulic drive device at the time of considering as an actuator etc. becomes unnecessary, it becomes advantageous in respect of cost.

[0078] Moreover, with this operation gestalt, since the needle bearing 35 was infixed between the drive cam 15 and end face section 24a of the link arm 24, 15d of peripheral faces of cam section 15a and the coefficient of friction mu between base 24a inner skin 24c become sufficiently small. For this reason, dispersion in the torque characteristic of a control axis 32 is prevented not to mention always smooth rotation of the drive cam 15 being obtained.

[0079] As a result of the stabilization of torque of this control axis 32, stabilization of the rotation position control of the control axis 32 by the electric actuator 29 can be attained, for example, stabilization of the lift control from this maximum lift region to the minimum lift region can be attained. Therefore, according to engine operational status, smooth and the valve-lift control by the stable actuation are obtained, and the thing of the adjustable device 19 for which an engine performance is fully demonstrated becomes possible.

[0080] In addition, it cannot be overemphasized that components mark will become fewer and it will be made to a compact if the predetermined pivot which this invention is not limited to the configuration of said operation gestalt, and the rocking cam 17 rocks is constituted so that a driving shaft may serve like this operation gestalt although it is good also as a thing different from a driving shaft.

[0081]

[Effect of the Invention] Since it will be in a valve idle state, i.e., a close-by-pass-bulb-completely condition, by controlling by the above explanation clearly the valve lift of the inlet valve which is an engine valve, or an exhaust valve to zero according to invention according to claim 1 at the time of braking of a car when an operator's demand deceleration is below a predetermined value, while friction decreases, the gas exchange loss by the induction-exhaust valve is avoided, and the so-called engine brake stops being able to start easily. Consequently, moderation of the wheel by the internal combustion engine is controlled, and the recovery effectiveness of the regeneration electrical energy by the electric motor becomes high.

[0082] Moreover, since a gas exchange is not made, too much cooling of an exhaust air catalyst is prevented, and the purification performance degradation of this exhaust air catalyst is prevented.

[0083] Since engine brake is also made to operate besides braking by the usual oil pressure in order according to invention according to claim 2 not to carry out zero lift control of the engine valve, that is, to perform pump actuation by the gas exchange, when an

operator performs for example, slam-on-the-brake actuation, powerful damping force is acquired.
[0084] According to invention according to claim 3, recovery of too much regeneration power by the electric motor can be prevented, securing a desired dc-battery charge.
[0085] According to invention according to claim 4, at the time of failure of the brake mechanism by the usual oil pressure etc., it becomes possible to secure engine brake at least.
[0086] According to invention according to claim 5, since the friction of the valve gear system at the time of an internal combustion engine's restart can be reduced, good restart nature or the start nature of a good car is obtained.
[0087] Since this lift change can be continuously reduced gently-sloping in case the valve lift of invention ****** according to claim 6 and an engine valve is controlled for example, from a high lift to a zero lift, a rapid actuation change of engine brake can be prevented and the stable brake feeling is obtained.
[0088] Since it can be made to operate with said regeneration power by having used the electric actuator while enabling a zero lift to a high lift to control the amount of valve lifts of an engine valve greatly enough according to invention according to claim 7, while being able to aim at a deployment of regeneration power, an oil pressure driving source, an oil pressure drive, etc. become unnecessary separately.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The whole schematic diagram showing the operation gestalt of this invention.
[Drawing 2] A view Fig. of drawing 3 showing the lift adjustable means with which the embodiment of this invention is presented.
[Drawing 3] The important section perspective view of this lift adjustable means.
[Drawing 4] The perspective view of the drive cam with which this lift adjustable means is presented.
[Drawing 5] The profile property Fig. of the cam side of the rocking cam with which a lift adjustable means is presented.
[Drawing 6] The fragmentary sectional view of this lift adjustable means.
[Drawing 7] A **** Fig. of drawing 3 showing the closing motion operating state of the inlet valve at the time of the minimum valve-lift (zero lift) control.
[Drawing 8] A **** Fig. of drawing 3 showing the closing motion operating state of the inlet valve at the time of the maximum valve-lift control.
[Drawing 9] The valve-lift property Fig. of this operation gestalt.
[Drawing 10] The flow chart Fig. showing control of the controller at the time of car braking.
[Drawing 11] The flow chart Fig. showing control of the controller at the time of a halt of an internal combustion engine.
[Drawing 12] The schematic diagram showing the source control unit of power of the conventional car.
[Description of Notations]
1 -- Car body
2a, 2b -- Front wheel
5 -- Internal combustion engine
6 -- Electric motor
7 -- Lift adjustable means
8 -- Oil pressure brake mechanism
9 -- Controller
12 -- Inlet valve
13 -- Driving shaft
15 -- Drive cam
17 -- Rocking cam
23 -- Rocker arm
24 -- Link arm
25 -- Link rod
31 -- Potentiometer
32 -- Control axis
33 -- Control cam
41 -- Dc-battery
42 -- Brake pedal
45 -- Control circuit
46 -- Dc-battery charge detection sensor
47 -- Treading-in speed detection sensor

[Translation done.]

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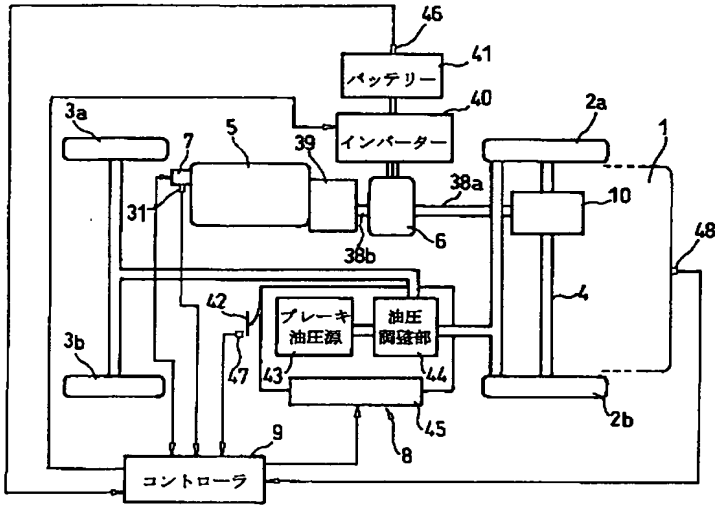
3.In the drawings, any words are not translated.

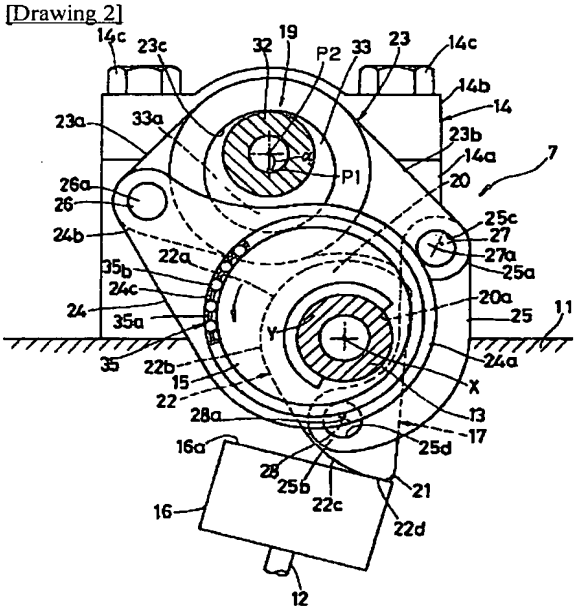
DRAWINGS

[Drawing 1]

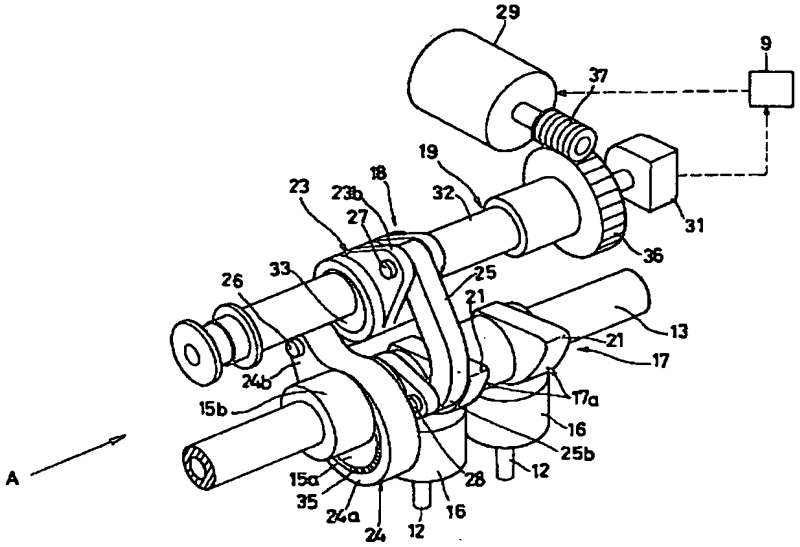


1…車体
2a, 2b…前輪
5…内燃機関
6…電動モータ
7…リフト可変手段
8…油圧ブレーキ機構
9…コントローラ
12…吸気弁
13…駆動軸
15…駆動カム
17…揺動カム
23…ロッカアーム
24…リンクアーム
25…リンクロッド
31…ポテンショメータ
32…制御軸
33…制御カム
41…バッテリー
42…ブレーキペダル
45…制御回路
46…バッテリー
充電量検出センサ
47…路込速度検出センサ

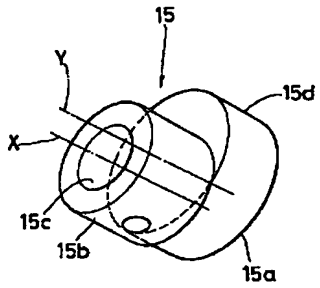
[Drawing 2]



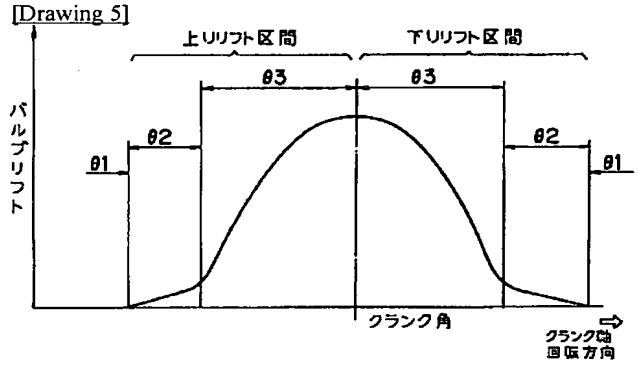
[Drawing 3]



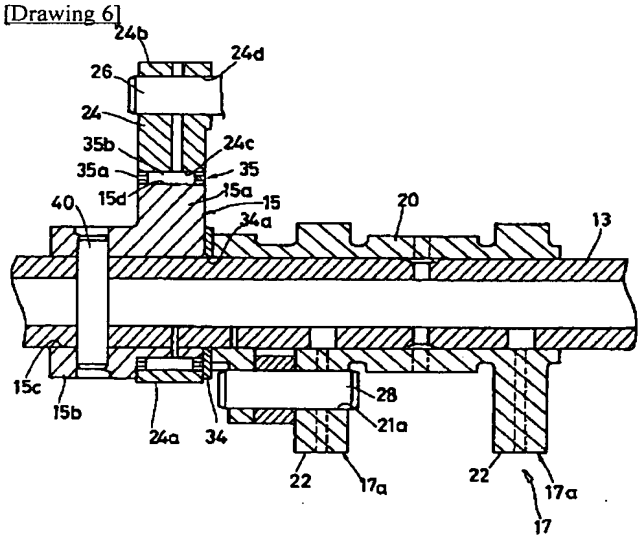
[Drawing 4]



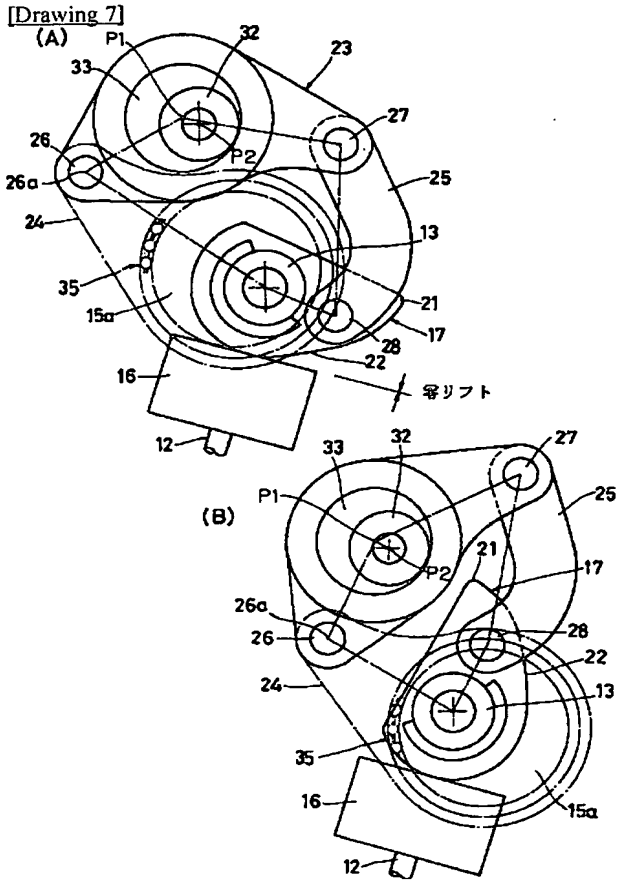
[Drawing 5]



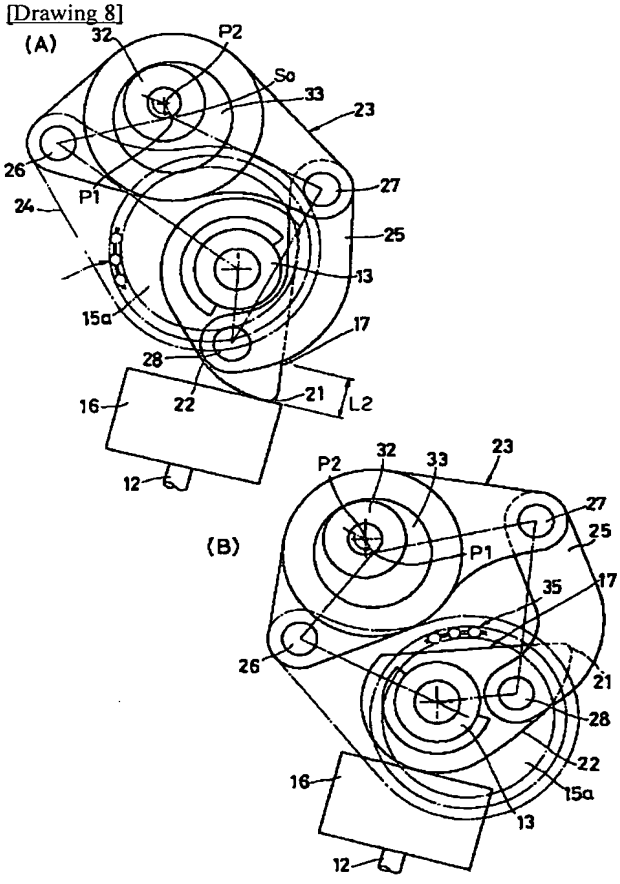
[Drawing 6]



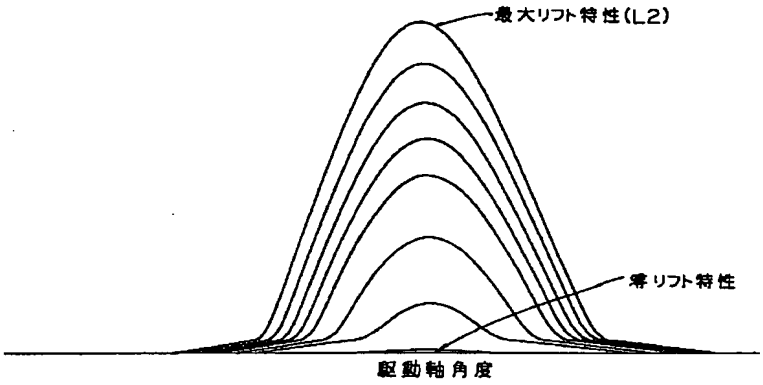
[Drawing 7]



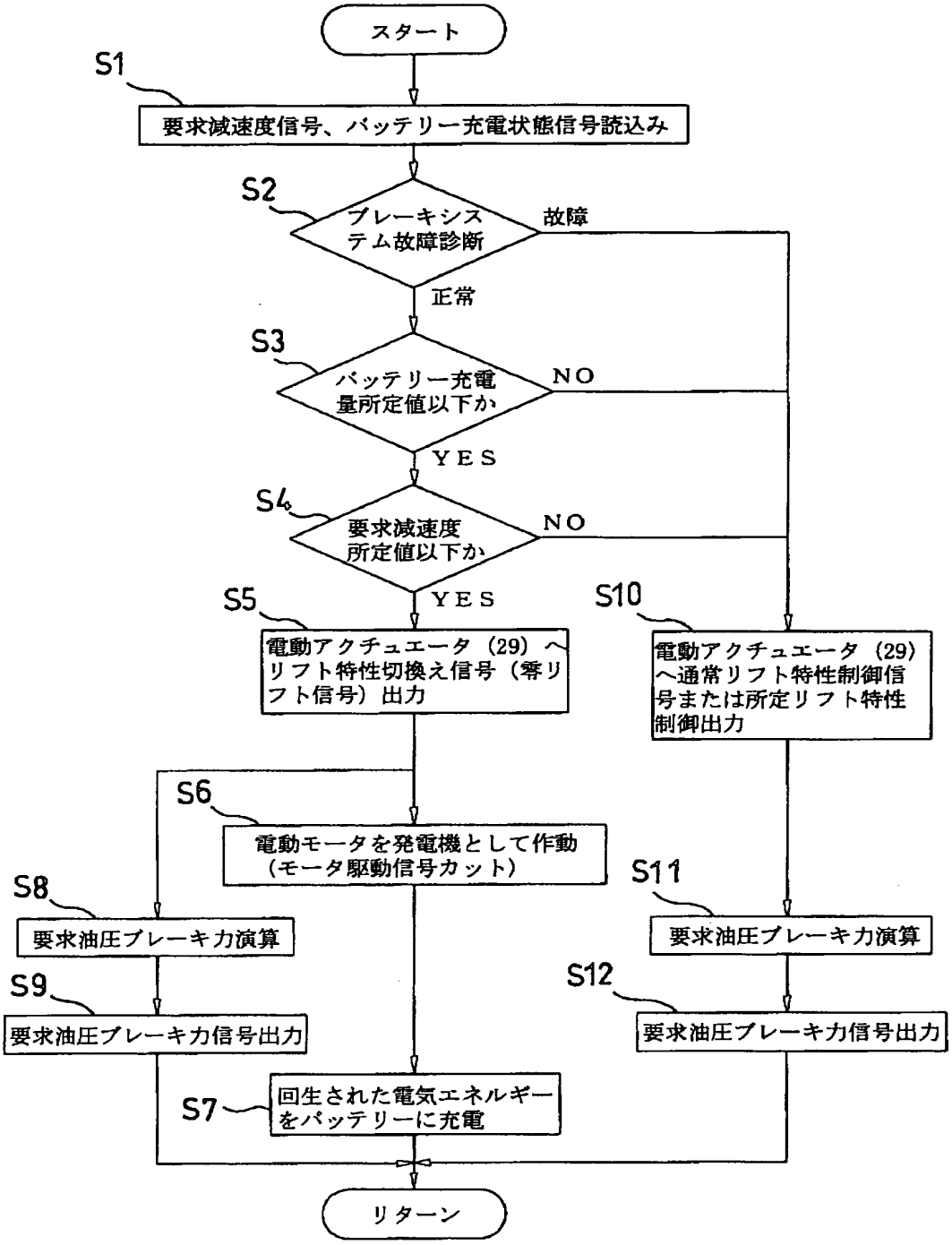
[Drawing 8]



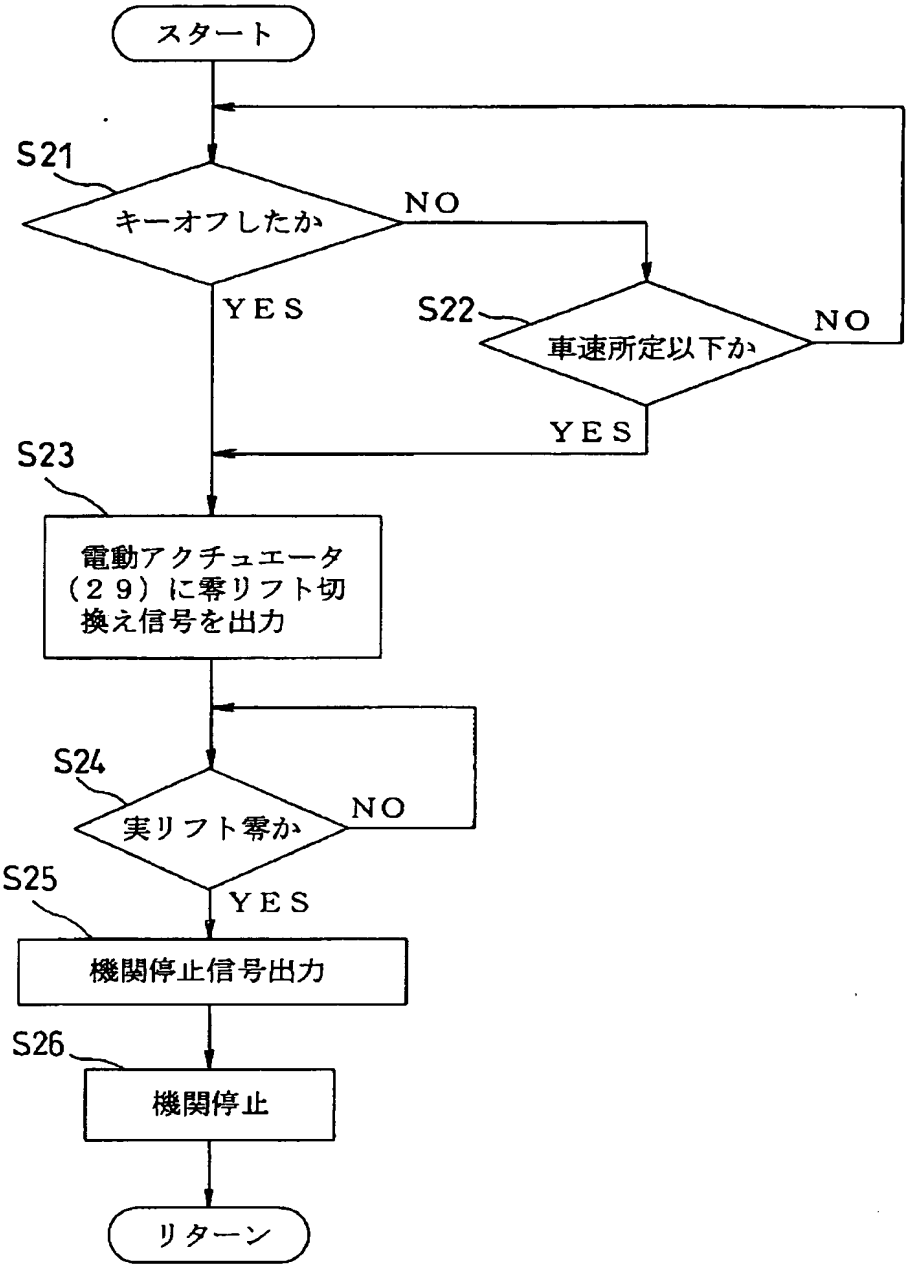
[Drawing 9]



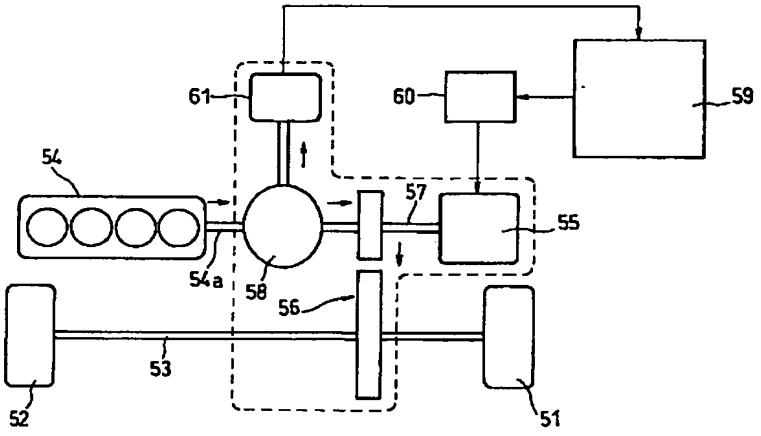
[Drawing 10]


スタート
S1
要求減速度信号、バッテリー充電状態信号読込み
S2
ブレーキシステム故障診断
故障
正常
S3
バッテリー充電量所定値以下か
NO
YES
S4
要求減速度所定値以下か
NO
YES
S5
電動アクチュエータ（29）へリフト特性切換え信号（零リフト信号）出力
S10
電動アクチュエータ（29）へ通常リフト特性制御信号または所定リフト特性制御出力
S6
電動モータを発電機として作動（モータ駆動信号カット）
S8
要求油圧ブレーキ力演算
S11
要求油圧ブレーキ力演算
S9
要求油圧ブレーキ力信号出力
S12
要求油圧ブレーキ力信号出力
S7
回生された電気エネルギーをバッテリーに充電
リターン

[Drawing 11]


スタート
S21
キーオフしたか
NO
YES
S22
車速所定以下か
NO
YES
S23
電動アクチュエータ（２９）に零リフト切換え信号を出力
S24
実リフト零か
NO
YES
S25
機関停止信号出力
S26
機関停止
リターン

[Drawing 12]


61
60
59
54
57
55
54a
58
56
53
52
51

[Translation done.]